

Deep UV Semiconductor Sourcess for Advanced Planetary Science Instruments, Phase I

Completed Technology Project (2009 - 2009)



Project Introduction

This proposal addresses the need for miniature deep UV light sources that operate at very low ambient temperatures without heating or temperature regulation for use in advanced in situ planetary science instruments involved in the reagent-less detection and identification of trace amounts of organic, inorganic, and biogenic materials. The proposed sources are aluminum gallium nitride (AlGaIn) semiconductor lasers and light emitting devices emitting between 210 nm to 250 nm, a spectral range which has been demonstrated to provide higher detection sensitivity and chemical differentiability than sources emitting at longer wavelengths. Instrument applications include non-contact, robot-arm or body mounted, reagentless chemical imaging instruments and detectors for analysis of chemical extractions from soil, rock, or ice employing non-contact, non-destructive native fluorescence and/or resonance Raman spectroscopic methods. The proposed semiconductor source approach avoids the problems that continue to limit emission wavelengths of semiconductor lasers to wavelengths above 340 nm. Using free electron injection we have demonstrated internal quantum efficiencies over 100 times higher than reported elsewhere. It is the goal of this program to demonstrate deep UV laser emission from a semiconductor device less than 250 nm using the proposed approach. This will lead to miniature, high efficiency, TRL 4 devices.

Anticipated Benefits

Potential NASA Commercial Applications: The deep UV semiconductor laser being developed here will enable a revolutionary reduction in size, weight and power consumption for UV resonance Raman and laser induced native fluorescence instruments for the detection and classification of biological, organic, and inorganic materials on surfaces and in liquids. There is a broad existing market need for deep UV sources that are small and efficient. The largest of these markets is likely in optical memory systems where the aerial data density is inversely proportional to the square of the source emission wavelength. However, other markets, while potentially smaller in quantity of demand, may have greater overall commercial impact, being the enabling technology for a wide array of analytical instruments. These instruments include biotechnology instruments used in clinical diagnostics, pharmaceutical research and product testing; environmental monitoring such as water, air and food quality; in semiconductor development and processing, and a myriad of other applications where small spot sizes or photon-energy-specific excitation is needed or enabling.



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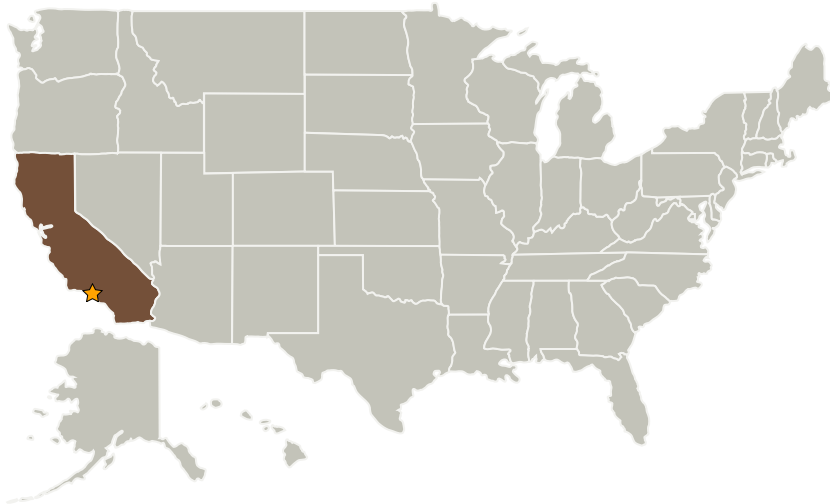
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Jet Propulsion Laboratory (JPL)	Lead Organization	NASA Center	Pasadena, California
Photon Systems, Inc.	Supporting Organization	Industry	Covina, California

Primary U.S. Work Locations

California

Project Transitions

 **January 2009:** Project Start **July 2009:** Closed out**Closeout Summary:** Deep UV Semiconductor Sourcess for Advanced Planetary Science Instruments, Phase I Project Image

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

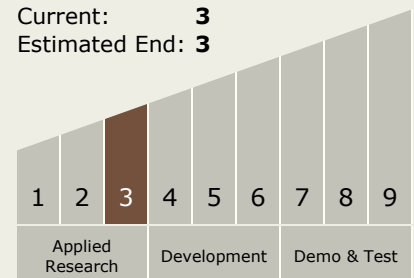
Program Manager:

Carlos Torrez

Principal Investigator:

William F Hug

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **3**

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Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.5 Lasers